A STUDY : INCIDENCE OF URINARY CALCULI IN ABDOMINAL PAIN CASES

ATTENDING MEDICAL COLLEGE HOSPITAL, JHANSI

THESIS
FOR
DOCTOR OF MEDICINE
(RADIO-DIAGNOSIS)

BUNDELKHAND UNIVERSITY
JHANSI (U.P.)

1991 RAVINDRA KUMAR GOYAL

CERTIFICATE

This is to certify that the work entitled A STUDY - INCIDENCE OF URINARY CALCULI IN ABDOMINAL PAIN CASES ATTENDING MEDICAL COLLEGE HOSPITAL, JHANSI, has been carried out by Dr. Ravindra Kumar Goyal himself in this department.

He has put in necessary stay in the department as required by the regulations of Bundelkhand University.

16/11/90

Dated:_____, 1990.

(H.N. SAXENA)
M.D., D.M.R.E.,
Professor and Head,
Department of Radiology,
M.L.B. Medical College,
Jhansi.

CERTIFICATE

This is to certify that the work entitled A STUDY - INCIDENCE OF URINARY CALCULI IN ABDOMINAL PAIN CASES ATTENDING MEDICAL COLLEGE HOSPITAL, JHANSI, which is being submitted as a thesis for M.D.(Radio-diagnosis) was carried out by Dr. Aravindra Kumar Goyal under my constant supervision and guidance.

The technique embodied in this work were under taken by the candidate himself. The results and observations were checked and verified by me periodically.

T. Pal. Jaiswal

Date: 15/11/90 1990

(T.B.L. JAISWAL)
M.D.
Reader,
Department of Radiology,
M.L.B. Medical College,
Jhansi.
(GUIDE)

CERTIFICATE

This is to certify that Dr. Ravindra Kumar Goyal has worked on A STUDY-INCIDENCE OF URINARY CALCULI IN ABDOMINAL PAIN CASES ATTENDING MEDICAL COLLEGE HOSPITAL, JHANSI, under my direct supervision and guidance.

His results and observations have been checked and verified by me from time to time.

Dated: 15.11.90, 1990

(A.K. GUPTA)
M.D.
Reader,
Department of Radiology,
M.L.B. Medical College,
Jhansi.

(CO-GUIDE)

CERTIFICATE

This is to certify that Dr. Ravindra Kumar Goyal has worked on A STUDY-INCIDENCE OF URINARY CALCULI IN ABDOMINAL PAIN CASES ATTENDING MEDICAL COLLEGE HOSPITAL, JHANSI, under my direct supervision and guidance.

His results and observations have been checked and verified by me from time to time.

Dated: 15/11/90, 1990.

(S.L. AGARWAL)
M.S., F.A.C.S.,
Professor and Head,
Department of Surgery,
M.L.B. Medical College,
Jhansi.

(CO-GUIDE)

ACKNOWLEDGEMENTS

Words are inadequate to express my deep gratitude and regards to Dr. H.N. Saxena, M.D., D.M.R.E., Prof. & Head, Department of Radiology, M.L.B. Medical College, Jhansi, whose fatherly figure, loving and tender behaviour in the department and vast knowledge of the subject enabled me to complete this work. Without his help, it was not possible for this work to see the light of day. I shall forever remain grateful to him for uninterrupted attention.

It is with a profound sense of gratitude and regards that I express my thanks to Dr. T.R.L. Jaiswal, M.D., D.N.R.E., Reader, Department of Radiology, M.L.B. Medical College, Jhansi, under whose kind and worthy guidance and supervision I had the opportunity to carry out this work. The present work bears at every stage the impress of his keen interest in the progress of this work and above all, constant encouragement without which the present work would have not been materialised. His firm initiative, valuable suggestions and unlimited help went a long way in completion of this work.

I pay my deepest regard to Dr. A.K. Gupta, M.D., Reader, Department of Radiology, M.L.B. Medical College, Jhansi, whose ever patronising behaviour, humanity, loving nature thorough knowledge, constructive

criticism at every juncture helped me harvest the fruit of present endeavour.

I am indebted to Dr. S.L. Agarwal, M.S., F.A.C.S., Prof. & Head, Department of Surgery, M.L.B. Medical College, Jhansi for his able guidance, valuable suggestions and encouragement to undertake this work.

I am thankful to my teacher, Dr. G. Kumar, M.D. Lecturer, Department of Radiology, M.L.B. Medical College, Jhansi, for his constant help and valuable suggestions.

I deeply value and admire the generous help extended to me by colleagues Dr. Arvind Saharan, Dr. Arun Shrivastava, Dr. G.G. Singhal and Dr. S.K. Srivastava, who were a constant source of encouragement throughout the work.

I shall ever remain thankful to Mr. Siddiqu Ali for his skilled, neat and faultless typing.

I am highly indebted to my parents and family members for their incentive and encouragement always.

Last, but not the least I owe a lot to my fiance, Alka who has always motivated me to do my best and also for her persistent help which she rendered all throughout the writing of the manuscript, and for being at my side whenever I needed her.

I dedicate this work to my parents and teachers to whom, I owe so much.

Dated: 15-11-90, 1990.

Ravinder Kumar Goyal

(RAVINDER KUMAR GOYAL)

CONTENTS

INTRODUCTION

INTRODUCTION

Urinary stones have affected mankind since time immemorial. Their occurrence is more common in certain parts in our country. They may remain silent for a long period in some patients but can be responsible for great misery in others. Stones increase the morbidity by producing haematuria, infection, anuria and renal damage. At times the renal damage is irreversible and may end fatally.

Frere Jacques (1651-1719), the famour lithotomist of the middle ages, usually commented "I have removed the stone, but God will cure the patient" (Garrison, 1929). It was stated so, probably because the etiological aspect of urolithiasis was not taken into consideration at that time and the pathological processes responsible for the initial formation of stones persisted even after their removal thus leading to recurrence.

Renal calculi are concretions consisting of crystals and a matrix of organic matter. Crystals usually constitute the predominent portion ($\geq$ 90%) of the mass of most calculi, but those occuring as a consequence of urinary tract infection have a higher proportion of matrix material. Occasionally this latter type of calculous may be almost devoid of crystals. Renal calculi are to be distinguished from calcific deposits

within the renal parenchyma. Such deposits occuring at sites of previous inflammation or degenerative, Change are designated by the term "nephrocalcinosis".

Many workers have tried to fathom the etiological factors responsible for the formation of stones in the urinary tract. Race, diet, occupation, climate, infection recumbency, congenital abnormalities, nephrocalcinosis etc. all have been blamed for their formation.

Well defined stone belts exist all over the world. (Anderson, 1969). Stones are common in England in Norfolk, Cambridge shire, Suffolk, North Wales, Derbyshire and West Moriand. It is fairly common in Northern Ireland. The highest incidence of urinary stones is found in Holland, Eastern France, the Balkans, the Volga Valley, Lower Egypt and Southern China (Ian Aird, 1957). In our country the stone belt is in the Northern part of the country, especially Punjab, Rajasthan and Western Uttar Pradesh (Sangham Lal, 1962).

The geology of these areas is very varied and in hardly two areas is it the same, so that such factors as hardness of water, content of the soil and climate, are probably less important than the dietary habits, constituents of diet, occupation, education and socioeconomic status (Ian Aird, 1957).

None of the research workers have yet highlighted any important or particular factor responsible for the

formation of stone in a particular stone belt. Perhaps entirely different factors are responsible in different parts of the world or even in the different parts of the same country.

The formation of renal calculi is thought to be dependent on the presence of metastable concentrations of crystalloids, but there must also be a component or nidus promoting the formation and aggregation of crystals. Whatever the initiating events, the growth of most calculi is dependent on the presence in urine of metastable concentrations of crystalloids. Such states of supersaturation may be achieved by various mean s by increased excretion of specific crystalloids of limited solubility, decrease in urinary pH which converts urates to less soluble uric acid; or infection with urea splitting bacteria to release ammonia, which causes an increase in urinary pH and provides a setting for crystallisation of magnesium ammonium phosphate or calcium phosphate complexes. In addition to increased concentrations of crystalloids or alteration of urinary pH, reduced excretionsof those urinary constituents that normally inhibit crystal formation would also induce a metastable state of crystalloids. This latter type of change is possible of more importance to the development of idiopathic calcareous calculi than is increased excretion of calcium or oxalate.

The aim of this work therefore had been to screen all patients of urinary calculi who sought admission in the M.L.B. Medical College Hospital, Jhansi during the periods of this study for following :

1. To evaluate the incidence of urinary calculi in the hospital as a cause of pain in abdomen.
2. To find the incidence of stones in various age and sex groups.
3. To find the incidence of stone formation in rural and urban area which is dry, rocky and having lot of minerals in the water.
4. To evaluate dietary habit with stone formation.
5. To find out the relationship of stone formation with different mode of water drinking.
6. To correlate socio-economic status with stone formation.
7. To find the common sites of stone at the time of investigation.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

HISTORICAL

Urinary lithiasis is a disease which is as old as civilisation itself. It is from Egypt, where so many mummies have been available, that the most ancient evidence of this fact has come. The findings, however, indicate that the disease was not very common in these far off times as Elliot Smith, after an examination of 9000 mummies found only 3 cases of urinary calculi (two apparently renal and one vesical). It has been stressed that the large majority of cases of urinary calculi in those days occurred as cases of vesical calculi in the young and were confined mostly to the lower classes. These have been specially studied by Marc. Armand Ruffer (1859 to 1917), who described three vesical calculi found by Flinders Petrie in a predynastic skeleton. Further cases of vesical calculi and three of kidney stones were discussed by Grafton Elliot Smith (1817-1837) and Dawson. The most important discovery in this connection was made by Ruffer, who in 1909 saw in the kidney of two mummies of the XXth dynasty (1250-1000 B.C.) large numbers of calcified eggs of Schistosomium Haematobium located mostly in the straight tubules.

Hippocrates (460-370 B.C.) in"Airs Water and Places" describes :

"The effect of drinking water collected from many different sources, that is from large rivers fed by smaller streams and from lakes into which many streams flow from different directions, is to cause a propensity to stone greves in the kidney, strangury, pain in the loins and rupture".

In ancient Indian writings, four types of stones have been mentioned corresponding to the phosphatic, oxalate and uric acid calculi. In Ayurveda the operation of suprapubic lithotomy has been described, and this probably is the most ancient record available.

Hippocrate (460-370 B.C.) in his writings discussed the symptoms and treatment of renal and vesical calculi. Lithotomist in those days were men of special experience and skill. The Hippocratic oath includes the following "I will not use the knife either on sufferers from stone, but I will give place to such as are craftsmen therein". This understanding enacted by Hippocrates exercised its influence on the attitude of the medical profession towards the treatment of vesical calculus for the best part of 2000 years.

The first X-ray diagnosis of a renal calculus was made by MacIntyre in 1896 and was verified at operation.

EPIDEMIOLOGY OF URINARY CALCULI

The study of this non-communicable problems of urinary calculi from the epidemiological aspect is important because, before any endeavour is made to deal with this problem it is essential to know its distribution and determinants of disease prevalence, in the human population. The epidemiology of urinary calculi may conveniently be reviewed under the following heads :

Geographical distribution

Global Distribution

It has long been known that stone is common in certain areas and rare in others. The boundaries of these 'stone areas' were often sharply defined and this curious patchy distribution gave rise to much discussion. Perhaps the largest and the most important 'stone areas' in the world are in Central Russia, Mesopotamia (Iraq), North-West India and South China (Canton). The soil, the amount of lime in the water and the climate were in turn supposed to be the principal factors determining the frequency of urinary calculi. But, since these above stone areas very widely regarding soil, water and climate, it is now generally believed that these factors are comparatively unimportant (Joly, 1934).

Almost concomitantly with the decrease of bladder stone there has been increase in the incidence of renal stone. This is clear from both the hospital records (Hedenberg, 1951, Andersen, 1966, 1969) and population studies (Nolen, 1976, Scot, 1977).

In Europe, the occurence of urinary calculi has been reported from Czechoslovakia, Norway, Sicily, Turkey, Spain, North Ireland and England (Suter et al). In South America, stone is a common occurence in North and Central China, portions of Argentina, North East Brazil and to a lesser degree, in South Brazil (Anderson, 1940). In Asia, though China and India are well documented stone areas, Thiland, has perhaps the highest incidence of primary vesical lithiasis in the world (Unakul, 1961).

Distribution within India

Way back, in 1894, Captain Robert demonstrated the regional basis of occurrence of urinary calculi in India. Prior to 1920 there were only strong reports on the incidence of calculus disease in the country and were essentially restricted to problem of bladder calculi. Such views are to be discarded as they were subjective views and not offering any objective data. The first useful report was that of McCarrison et al (1931). Following an extensive survey, May estimated the overall incidence of stones in India as 10 per 1,00,000

of the population. They also pointed out some regional variations. Thus for Punjab it was 438/1,00,000 of the population for Hyderabad 266/1,00,000 for Ahmed Nagar 13/1,000, for Assam 84/1,00,000, for Saharampur, U.P. 25/1,00,000.

L.S. Joshi (1945) by studying the distribution of the tertiary rocks in India has concluded that in a given area the regions which are calcareous and which have large rivers are the ones, which show more stone incidence than the surrounding parts. The incidence of calculus is more along the right bank of river Indus with tertiary rocks than the left bank without the tertiary rocks.

From 1939 to 1957, Anderson studied the problem of lithiasis in Ahmednagar, a rural town in Maharashtra, and encouraged by his findings, extended his work to an All-India study of the hospital incidence pattern in 123 Mission Hospitals and 22 Government Medical Colleges (Anderson, 1962). A comparision of their reports is shown in table-1.

TABLE-1 SHOWING THE INCIDENCE OF URINARY LITHIASIS IN VARIOUS REGIONS OF INDIA IN THE DECREASING ORDER OF FREQUENCY

Captain Robert (1894)	Anderson (1962)
1. Punjab	1. North-West India and North-East India.
2. North-West Frontier Province and Bombay.	2. Central Zone, Mysore and West Bengal.
2. Madras and Assam.	3. South and South-East India.

A survey between 1951 and 1957 in Ahmed Nagar area by Anderson produced figures varying from 3.5 to 8.5/ 1,00,000. The hospital incidence in Ahmed Nagar at that time showed majority of bladder stones in children and a small number of renal stones in adults. Reports from 39 hospitals in India collected by Anderson from 1951 to 1958 revealed the proportion of 1109 bladder to 195 kidney stones. This report also revealed that only 2.9% of cases were in female. The Haffkine Institute Survey of 1953 to 1955 pointed out a higher incidence of bladder stones in rural areas than in large urban centres.

Colabawalla (1971) in a survey (by questionnaire) covering 80 localities (60 institutions) in the country noted an overall incidence of urinary calculus to be 50/10,000 hospital admissions. He could delineate two belts of high incidence, one belt starting from Amritsar in the north extending to areas to the north west including Delhi and Agra, the other belt starting from Jamnagar in the west coast extending towards central India to Jabalpur. In 21 localities a high incidence of upper urinary tract calculi was noted (U.U.T. 89/10,000 hospital admissions, L.U.T. 40/10,000 hospital admissions). In 18 localities the incidence of upper and lower urinary tract calculi was the same (U.U.T. 27/10,000 admissions, L.U.T.

25/10,000 admissions). In 11 localities a higher incidence of lower urinary tract calculus was noted (U.U.T. 35/10,000 admissions, LU.T. 61/10,000 admissions).

This study would suggest that overall incidence of upper urinary tract stones is slightly higher than the lower urinary tract stones. This is an observation at variance with earlier reports. This may be indicative of a genuine change in the pattern of urolithiasis in this country. In this regard the study by Bapna et al (1971) is of significance. He noted an incidence of upper urinary tract stones in children to be 0.62 percent (62/10,000) of hospital admissions.

Age Incidence

Urolithiasis in young boys is one of the earliest known diseases of man (Hippocrates, Galen, Celsus, Sushruta etc.). The frequency of vesical calculus in childhood has become a subject of comment all through medical history. Hippocrates and Aretaeus have spoken of bladder stones in children and Galen called it a 'Malady' proper to boys. Celsus preferred to operate only on boys between the age of 9 and 14 years. The oldest vesical calculus was found in the bones of a teenage boy while the renal calculus discovered in Fulton country belonged to a parous mother. Thus it

appears that this malady has probably afflicated all age groups from time immemorial.

In 1905, Major Davidson of the Indian Medical Service stated that he had seen uric acid calculi in children recently born and was of the opinion that they had formed during intra-uterine life (quoted by Daland, 1935). Dugan (1911) reported cases of urethral stone in male of the following age : 4 days, 8 days and 1 month. In the later half of the 19th century, the first sign of a great change in the age incidence of calculus disease was observed. The incidence of bladder stones began to get less in children but the incidence of renal and vesical calculi in adults remains the same (Joly, 1934).

The age group in which urinary calculus is predominant has a relation with the socio-economic development of the people of that area. In India (developing nation), during 1939-1957, there was predominance of bladder stone (lower urinary tract LUT) in children in rural areas, while adult renal stone (upper urinary tract - UUT) was more prevalent over juvenile bladder stone in three largest cities. In Norway (industrialised and economically advanced nation), during 1853-1960, there was no incidence of

primary bladder stone in children, while there occurred a 200% increase in the incidence of adult renal stones from 1920-1960. In Sicily (nation in the intermediate group), during 1925-1962, there was a decrease in the overall incidence of calculi. There was also an increase in the incidence of renal calculi in adults (Anderson, 1968). For comparison of regional differences in incidence of urinary calculi in India, Norway and Sicily, Anderson used Hospital stone indices of the following four main varieties :

1. LUT in children per 10,000 children admissions - Type I
2. LUT in adults per 10,000 adults admissions - Type II
3. UUT in children per 10,000 children admissions - Type III
4. UUT in adults per 10,000 adult admissions - Type IV
5. Total urinary stones per 10,000 total admissions - Type V

The age incidence pattern of urinary calculus by various workers is as follows :

SHOWING AGE DISTRIBUTION OF STONES IN INDIA

Worker	Year of work	Area of work	Pattern
Shah	1950	Gujrat	174 BS,91.62% below 10 yrs. UUT 85,4.2% below 10 yrs.
Das	1960	Lucknow	82 LUT,55 below 10 years UUT 32
Mehindir-atta	1961	Delhi	34 LUT,19 below 10 years 42 UUT second and third decade
Anderson	1962	Ahmad Nagar	103 LUT 60% below 15 years
Sen & Goel	1965	Delhi	1142 LUT 624;340 below 10 years, UUT 518;20 below 10 years
Hazarika and Rao	1974	Delhi	136 LUT 74, Maximum below 10 years, UUT 53

LUT = Lower Urinary Tract, UUT = Upper Urinary Tract
BS = Bladder Stone, URS = Ureteric, KS = Kidney stone

SHOWING AGE DISTRIBUTION OF STONES OUTSIDE INDIA

Worker	Year of work	Country of work	Pattern
Civalle	1838	France	More than half below 20 years, rare in children.
Yelloly	1929	Norfolk & Norwich	640 bladder stones Less than 14 years - 292 15 - 40 years - 155 Above 14 years - 202
Noble	1931	Siam	20% below 10 years
Chaulk	1931	England	162 LUT, 3 below 20 years
Jolly	1934	England	0.9% below 10 years
Waller and Anday	1950	U.S.A.	0.9% below 10 years
White	1954	England	219 LUT, 15 below 20 years
Rukstein	1961	Turkey	119, 38% LUT, Maximum below 15 years, 42% UUT
Unakal	1961	Thiland	2549 LUT, 47.9% below 10 yrs.
Chantikoram	1967	Thiland	3426 BS, 47.2% below 5 years, 847 Urethral 62.4% below 5 years, 408 UUT.

Sex Incidence

Urinary stone disease has predilection for males. The male/female ratio however varies according to the site of occurrence of calculi. In UUT one male/female ratio is 3:1 though slight variation have been reported by various workers among the UUT stones the male : female ratio has been reported from 2:1 to 34:1 but as one descends from kidney to urethra the male : female ratio progressively rises. The observation regarding sex incidence of various workers have been summarised in the table.

Anderson (1963) postulated that anatomical variation was the governing factors in the occurrence of urinary tract stones. Dutt (1956) and Mangnekar (1962) have also observed that sex hormones have a bearing in stone formers. This may reflect the effect of oestrogens in increasing urinary citrate excretion since this has solubilising effect on calcium oxalate.

SHOWING MALE : FEMALE RATIO IN URINARY CALCULI

	Year	UUT	LUT
Indian Workers :			
Shah and Jalundawala	1950	4.7 : 1	34 : 1
Das	1960	3.5 : 1	31 : 1
Nathani	1962	3.1 : 1	18 : 1
Anderson	1962-63	7.6 : 1	33 : 1
Sen and Goel	1965	3.4 : 1	15 : 1
Mahindrutta	1970	3.0 : 1	2 : 1
Hazarika & Rao	1974	2.7 : 1	17 : 1
Gupta	1981	4.17: 1	10.56:1
Others :			
McCarrison	1931	3.0 : 1	
Harrington	1940	1.6 : 1	
Wineburg & White	1954	1.6 : 1	6.4 : 1
Dutt	1956	2.0 : 1	
Eckstein	1961	1.2 : 1	
Chautiboran	1967	4.1 : 1	10.1 : 1

Race, Religion and Heredity :

Stone is most common among European, Hindus, the Arabs and Southern Chinese Joly (1934) believed this to be due to defective diet and hygiene. In South Africa,

the indigenous Bantu are rarely afflicted by renal stone who were living within their tribal environment (Vermooten, 1937, Wix and Kark, 1961) whereas the condition is as common in the white and Indian population as it is in Europe and North America. Benson (1935) remarked on an apparently similar racial immunity of the Negro when compared with the Caucasian in the United States of America but Dodson and Clark (1946) found an increasing incidence of renal stone in Negros which adopted the same life style resembling of caucasian countrymen. This has not happened in those Bantus who have become urbanised but retained many of their tribal dietary habits. Boshmer (1961) found that there was no evidence of racial predisposition.

Anderson (1968), after comparing Europeans, Indians and Bantus, concluded that the differences observed provided no evidence of racial immunity or predisposition, because of the persistent dietary and other differences in customs between the races. Winsbury and White have also emphasized that renal calculi should not be ascribed to genetic factors unless the influence of dietary factors have been taken into account.

Heredity plays a role in causation of stone was proved by MacGregor (1960), Bates and Krienk (1958) and Gronman (1938) found either a familial pattern in stone formation or a greater incidence in the siblings and

parents of known stone former. In a recent study, Lyunghall and Nedstrand (1975) found the association of atleast one first degree relative in 29.4% of stone patients compared with 15.3% of stone free control subjects in a population survey.

Socio-economic status

The problem of lithiasis is equally rampant among the rich and the poor. The site of stone and the age of stone occurrence are however governed by the socio-economic status. Thomson (1921) noted that stone was comparatively rare in children of well-to-do parents. Anderson (1968), in a study from 1953 to 1960 in Oslo City Hospital, Norway, found no primary bladder stone in children. However, Anderson (1968) and Chatterjee (1967) found lower urinary tract stones to be endemic in children of India and Thailand, respectively.

Europe faced an epidemic of lithiasis during the 16th, 17th and 18th centuries. It was in these years that Europe saw a lot of war, food shortage and poverty. With the improvement in the socio-economic status in the past two centuries, England and France have seen a remarkable change in the incidence of lithiasis. There was a shift from stones of the lower urinary tract to stones of the upper urinary tract. Norway saw a 200% increase in incidence of upper urinary tract stones from 1920 to 1960 (Anderson, 1968). It will not be wrong to state

that lower socio-economic status is associated with stones of the lower urinary tract in children and upper socio-economic status is associated with stones of the upper urinary tract in adults.

Climate :

There are reports of seasonal variations in incidence both from U.S. (Prince and Scardino, 1960), Australia (Bateson, 1973) and the United Kingdom (Robertson et al 1975). In change from temperate to tropical climates and in seasonal change the factors implicated are increase ambient temperature, which causes increase fluid loss leading to excretion of smaller volumes of urine of high specific gravity and solute concentration. The effect of this is relative stasis in the UUT. The second factors is increased exposure to ultra-violet rays, with increased intestinal absorption of calcium from augmented vitamin D stimulation, the reduced intestinal content of calcium will leave larger amount of free oxalate for absorption and subsequent urinary excretion (Hodgkinson, 1976).

Diet :

There is a definite relationship not only between endemic stones of the lower urinary tract and diet, but also and perhaps still more important, with stones of the upper urinary tract.

The first proof of the influence of diet on the incidence of lithiasis was put forward by Osborne and Mendel (1917) who found frequent incidence of stone in rats fed on diet deficient in fat soluble vitamins. Mac Carrison by his work in India, corroborated the above mentioned work and also came to the conclusion that cereals taken as staple food also accentuated stone formation. Addition of butter, milk and cod liver oil prevented stone formation and vegetable oil did not. Addition of calcium to the deficient diets, resulted in an increased incidence of stone formation. He also found that lack of sufficient phosphates to combine with the calcium present, increased the incidence of stone formation.

After extensive experiments on rats, McCarrison (1931), summed up the dietetic factors concerned with stone-formation into two groups :

1. Positive Factors : whose excess leads to stone-formation, like excess of lime salts, and some inherent stone forming substances present in cereal foods such as whole wheat flour, oatmeal, Indian millet, white flour and rice in decreasing order of potency.
2. Negative Factors : whose deficiency leads to stone-formation, like Vitamin - A deficiency, or Magnesium deficiency or pyridoxine deficiency or deficiency of phosphates relative to the amount of lime in diet.

Meldin (1968) did a dietary survey of the Bantu inhabitants of the Republic of South Africa. He found a similar food pattern : Maize, sorghum, beans and pumpkin, supplemented on occassion by meat. He assumed that the well ingrained dietary habits, producing a particular pattern of urinary composition, are responsible for the Bantu's freedom from renal stone disease.

Anderson (1968), after a comparative study of dietetic habits in India, Norway and Sicily, propounded a hypothesis that, "The national and regional dietary structure provides the base line of stone incidence in all countries or regions, in addition to which other factors, intrinsic or extrinsic, inherited or acquired, major or minor, play either a apositive or a negative role".

Deficiency of certain things in diet have relationship with the stone formation. Deficiency of vitamin 'A' of animal origin and a deficiency of absorbable calcium in the diet independently of vitamin lack have been amply proved to be important faults.

Higgins and others (1936) have demonstrated that lack of vit. 'A' was common in cases of renal calculus. This state was ameliorable by prolonged administration of vit. 'A'. This was confirmed by Pyrah (1955). A number of other workers, however, have failed to confirm these findings. Thus, as far as renal lithiasis is

concerned, scientific workers are not unanimous as to the role of deficiency of vit. 'A' in diet in the causation of renal calculus.

Anderson (1972), whilst suggesting that increase in dietary protein of animal origin might be responsible for the reduction in endemic bladder stone in Sicily, drew attention to the high content of animal protein in the dietary of the industrialised countries, and he postulated that the prevalence of renal stone in these countries might in some way be connected with it. It is also evident from the same source, although not specifically remarked on by Anderson, that the areas of greatest average daily sugar consumption per person of are also there in which upper urinary tract stone is most common. By contrast, in Africa where urolithiasis is rare, sugar consumption is very low : the native Bantu of Africa, living in a tribal environment has daily sugar consumption less than a tenth that recorded for the technically developed nations. Cleave and Campbell (1966) in the concept of a 'Saccharine disease' referred to the significant increase in the consumption by the technically developed countries of refined carbohydrate in the form of sugar and sugar products in the later half of the 19th century and progressively during this century. A dietary change of this magnitude occurring over the same period of time as that of the reported

increase in incidence of renal stone encourages conjecture that these phenomenon may be related. There is support for such an hypothesis from comparison of the graph of incidence of renal stone since the turn of the century (Anderson, 1969) with cleave's graph of sugar consumption of technically advanced country (U.K.) which shows that checks in the rise of incidence of renal stone appear to coincide with the temporary drop in sugar consumption of the first and second world war years.

Mild metabolic acidemia is observed following glucose ingestion, thus urinary calcium excretion is increased due to renal tubular acidosis (Lemon, Piering and Lemann, 1968). Citrate excretion may be reduced in similar circumstances. Glucose induced calciuria was noted to be closely correlated with simultaneous increase in urinary net acid excretion (Lemann, Piering and Lemon, 1969) and there may be further significance in respect of the latter than the solubilising effect of citrate appeared to be pH dependent and markedly reduced at pH 5 (Chukkaratana, Van Reen and Valyasevi, 1971).

There is, therefore, evidence that dietary carbohydrates in the refined form can cause an increase in the urinary concentration of calcium and perhaps also of oxalate, two of the main constituents of renal calculi, whilst at the same time reducing urinary solubilising and crystal inhibiting properties.

Urinary Tract Infection

Urinary infection frequently accompanies renal calculi and infections, especially with urea splitting organisms, are often regarded as being of great importance in formation of stone. Urea splitting organism increase the alkalinity of the urine, which would increase the tendency to precipitation of calcium phosphate and magnesium ammonium phosphate.

Carroll and Breman (1951) have reported that all strains of proteus and about 56% strains of staphylococci, regardless of whether they are albus or aureus, haemolytic or non-haemolytic will split urea. Occasionally E.coli and other had power to split urea.

It has been suggested that bacterial infection may influence stone formation by alteration of existing urinary colloids or through introduction of a foreign colloid in a inflammatory exudate. However, many cases of renal calculi occur in the absence of urinary infection.

There is no direct evidence that infection play any essential part in the initiation of calculi, although it seems probable that it may encourage the growth of calculi in those already predisposed to them.

High concentration of urinary salts

Albright and his colleagues (1939) have described a syndrome, which always occur in males, known as

"Idiopathic hyper-calciuria". This is characterized by renal stones, increased urinary excretion of calcium and low serum phosphorus without elevation of serum calcium. These workers now imply that in patients with renal stones who have a normal calcium, hypercalciuria is always accompanied by a lowered serum phosphorus. While Flocks (1940) and others have reported that 60% of patients with renal stones excreted increased amount of calcium in urine. Serum calcium and phosphorus levels were found to be normal.

MacCosum (1960) investigated in a series of patients attending a clinic for stone at the Royal Victoria Hospital, Belfast using a standard diet containing 154 mgms. of calcium per 24 hours. They found that normal control subjects excrete from 48 to 148 mgms. of calcium per 24 hours. The urinary excretion of calcium has been estimated in 73 patients suffering from stone, who were on the same diet, and has been found 30% of them to the greater than the mean of the control and was thus considered to be increased. This figure includes six patients who were found to have hyperparathyroidism.

Zaigal et al (1949) in a study of 15 patients with urolithiasis observed that 14 had a definite increase of renal excretion of calcium. Hyperparathyroid had been excluded in all of the 14 cases with increased excretion of calcium. 7 had impairment of renal function while

the rest of the 7 were normal. Thus they found that hypercalciuria was present associated in some patients of renal lithiasis, although not always, with deranged kidneys.

pH of urine

Calcium phosphate and magnesium ammonium phosphate become more soluble as the pH of the solution, approaches neutrality and the alkaline range and therefore, the pH of the urine might be expected to influence the stone formation.

The solubility of calcium phosphate is markedly increased in acid urine. Uric acid and cystine become increasingly soluble in alkaline urine, alkalinisation therapy is, therefore, indicated to prevent calculi of these compositions. The solubility of calcium, Ca oxalate is practically unchanged over the clinical pH range. Therefore, change in pH is of no value in prevention of Ca oxalate deposition.

Hyper-parathyroidism

It has been estimated by Glenn (1965) that 5% of renal calculi are attributable to parathyroid tumours. Chute (1939) has reported that hyperparathyroidism was the cause in 2% of cases of urinary stones and 63% of cases with hyperparathyroidism had renal calculi and in 53% of these calculi were bilateral. Multiple stone were present in 73% of cases. The fact that there was no recurrence of the stone in these cases after the removal

of the parathyroid tumour is in evidence of the importance of hyperparathyroidism as the cause of stone formation. Most of the stones are composed of calcium oxalate. In the presence of infection and alkaline urine, the stone may be coated with magnesium and ammonium phosphate.

Retention of urine

This is an important predisposing cause of calculus in the urinary tract. With retention of urine, infection follows. Few cases of renal calculus are associated with obstructive lesions of the urinary tract, probably because the urine from an obstructed kidney is diluted. It is estimated that 7% of cases of urinary lithiasis are due to this cause.

Role of citrates

Citrates have been shown to form a soluble complex with calcium ions. Presence of citrates in the urine of normal persons was demonstrated by Ambard and McClure (1917). The amount of citrate excreted varies with the output of calcium and pH of urine, being higher in alkaline than in acid urine.

It has been suggested that diminished excretion of citrate by the kidney is an important factor in the etiology of stone. Oestrogen increase citric acid excretion and lower the output of calcium in the urine. Citric acid excretion is less in the stone form a subjects and stone are more common in men than women.

Prolonged immobilisation

Cabot (1910) for the first time recorded renal calculus in a patient with fracture of the spine with sterile urine. Wilson (1931) reported 23 stones in 150 men who had been immobilised in the first world war for three to twelve months. in all but two of these urine was sterile.

Recumbency calculi are still common having accounted for 30 out of 600 cases as reported by Pyrah.

Chemical composition of renal calculi

1. Calcium oxalate stones

It is the most frequent constituent of idiopathic renal calculi and is most commonly present as the mono-hydrate giving rise to the three types of stone :

(a) Hempseed - Small, smooth.

(b) Mulberry - Irregular

(c) Jack stone - Spiculate

2. Phosphatic stones

Two main types :

(a) Apatite (Basic calcium phosphate).

It comprises a series of salts with various calcium/phosphorus ratios, hydroxy apatite being the commonest.

(b) Struvite (Magnesium ammonium phosphate hexahydrate).

Magnesium ammonium phosphate is the commonest non-calcium containing constituents of stone and is

generally found in association with apatite, giving rise to large, stag horn calculi which occur in alkaline infected urine.

Uric acid and oxalate may be mixed with these types of stones.

The surface of phosphatic calculi may be rough or smooth. The colour varies exhibiting grey, white or yellow tints under different conditions. When composed of earthy phosphates, the calculi are characterised by their friability.

3. Uric acid calculi

Generally pure but may be associated with calcium oxalate or calcium phosphate. They are usually pigmented due to the adsorptive capacity of uric acid for certain urinary chromogens. The surface of such calculi is generally smooth but it may be rough and uneven.

4. Cystine calculi

Rarely found, it is soft in consistency and white or yellow in colour.

5. Xanthine calculi

Colour is from whitish to brownish yellow. Very often it is mixed with uric acid and urates.

6. Calcium carbonate calculi

It is rarely found in pure form in the human. Whenever is present, it is a constituent in a mixed calculus.

7. Urostalith calculi

Rare, composed of fat and fatty acid, soft when moist and brittle when dry.

8. Fibrin Calculi

Frequently occur as nucleus of other forms of calculus.

9. Indigo calculi

An occasional calculus was met within the last century amongst Indigo workers of Bihar. Now it is very rare.

10. Silica calculi

Silica stones in man were first reported from Sweeden in 1953. Two patients had taken magnesium trisilicate for peptic ulcer symptoms but they did not admit to taking more than the usual therapeutic amounts. Other workers also reported the findings of silica stones (Herman & Goldberg, 1960; Lagergreen, 1962; Jokes, Rose & Sutor, 1973). Their patients had passed stones many times before analysis of one of them by X-ray diffraction showed that it consisted mainly of opaline silica.

Silica stones are of low radio-density, yellowish in colour and very hard yet light for its size. Small amount of calcium, magnesium, oxalate and phosphate are sometimes present.

Silica stones have been produced experimentally in rats and dogs fed on a synthetic diet containing magnesium silicate and silicic acid as non-nutritive bulk items.

MATERIAL AND METHODS

MATERIAL AND METHOD

The present study "Incidence of urinary calculi in abdominal pain cases" was carried out in patients who were attending in the department of Radiology and Surgery with the history of abdominal pain. The following criteria was used for the selection of the patients.

Selection of patients

The patients attending indoor and out patient departments of this college with chief complaint of chronic abdominal pain associated with urinary symptoms like haematuria, increased frequency of micturition, dysuria or anuria were included in the series.

Detailed history of the patients were taken in the following order :

- Name
- Age
- Sex
- Address
- Socio-economic status
- Family history
- Dietary history
- History of mode of drinking water

CHIEF COMPLAINTS AND HISTORY :-

- Pain -
  - Site
  - Duration
  - Radiation

- Burning micturition
- Frequency of micturition
- Retention of urine
- Haematuria
- Fever
- Vomiting
- Any other complaint

EXAMINATION :-

- General examination
- Abdominal examination

INVESTIGATIONS :-

- Blood examination - TLC, DLC, Hb, ESR,
  - Blood urea
- Urine examination - Albumin
  - Sugar
  - Microscopic examination
- Plain X-ray abdomen in AP view
- Intravenous pyelography

Following materials were used for this study :

- X-ray films of different size
- Cassettes
- X-ray machine, Developer and fixer solution
- Illuminating box
- I.V. Contrast media - CONRAY 420 (May & Baker)
- Emergency tray

Preparation of patient for radiography

Preparation of the patient was done for plain skiagram abdomen and intravenous pyelography, because faeces and gases may obscure the urinary stone completely. Apart from it, low residue diet with mild cathartics and restriction of fluid over night was advised. Few patients required plain water enema three hours prior to the investigation. In cases of children glycerine suppository and antiflatulent (Meopeptine drops and syrup) were given prior to investigation.

Radiography

X-ray examination of the urinary tract was made with the patient in the horizontal position using potter Bucky Grid but on rare occasion the erect or sitting position were made. Routine projections were antero-posterior view, sometimes postero-anterior view, lateral view, lateral oblique and lateral decubitus view.

A preliminary scout film was taken both for demonstration of abnormalities and to establish whether the preparation of the patient was adequate or not.

X-ray factors for exposure of not more than ½ second were desirable. In general, 70-90 KV were used, but in infants, KV factors and exposure were reduced accordingly. Focus film distance was 90 cm. Film were used of different sizes.

Sensitivity of the contrast media to the patient was done by injecting one ml contrast media intravenously. Patients were observed for any untoward reaction. CONRAY 420 (May & Baker) was used for IVP. Usually 20 ml contrast media in single dose was used. On any untoward effects, emergency procedures were adopted in certain cases by using oxygen inhalation and parentral injection of corticosteroids, antihistaminics and cardiac stimulants.

Exposures were made after 2, 7, 15 and 30 minutes for nephrogram, calyceal pattern and physiological function of urinary system.

OBSERVATIONS

OBSERVATIONS

The present study was carried out in the department of Radiology and Surgery, M.L.B. Medical College and Hospital, Jhansi. The patients attending O.P.Ds. and Indoor Departments since September, 1989 to August, 1990 were included in the study.

Total 200 patients were selected ranging from one year to 60 years of age irrespective of their sex. According to age the cases were sub-grouped in the age groups-I (1-10 years) 5 cases (2.5%), group-II (11-20 years) 5 cases (2.5%), group-III (21-30 years) 30 cases (15%), group-IV (31-40 years) 50 cases (25%), group-V (41-50 years) 70 cases (35%) and group-VI included more than 50 years of age 40 cases (20%)

Table - I

Showing age incidence

Sl. No.	Age group (in years)	No. of Cases	Percentage
I	1 - 10	5	2.5
II	11 - 20	5	2.5
III	21 - 30	30	15.0
IV	31 - 40	50	25.0
V	41 - 50	70	35.0
VI	Above 50 years	40	20.0
	Total	200	100.0

Out of 200 cases 136 (68%) were males and 64 (32%) were females. Maximum cases were reported in both sexes in age group of 41-50 years 35% (70 cases). Thereafter 25% (50 cases) were of 31-40 years, 20% (40 cases) were above 50 years, 15% (30 cases) were of 21-30 years and rest 5 cases (2.5%) were in the age group of 1-10 and 11-20 years each. Detail of sex incidence in various age groups has been shown in table-II and III.

Table - II

Sex incidence

Sex	No. of cases	Percentage
Male	136	68
Female	64	32
Total	200	100

Table - III

Sex incidence in various age groups

Age group years	Male	Percentage	Female	Percentage	Total No. of cases	Percentage
1-10	2	1.0	3	1.5	5	2.5
11-20	5	2.5	0	0.0	5	2.5
21 - 30	25	12.5	5	2.5	30	15.0
31-40	30	15.0	20	10.0	50	25.0
41-50	46	23.0	24	12.0	70	35.0
Above 50	28	14.0	12	6.0	40	20.0
Total	136		64		200	

Detailed history of the patients were taken. Special reference were given to their living condition, socio-economic status, mode of drinking water and dietary habits. Most of these patients were found belonging to rural area (57%) and rest of urban area (43%) (table-IV).

Table - IV

Showing area of living

Area of living	No. of cases	Percentage
Rural area	114	57
Urban area	86	43
Total	200	100

According to the source of water the patients were divided in three groups. Most of the patients were dependent on their daily water intake either from open wells (44.5%) or by hand pumps (13%). 19.5% were depending on direct river water and rest were using tap water (23%) (table-V).

Table - V

Showing mode of drinking water

Mode of water supply	No. of cases	Percentage
Well	115	57.5
(a) Open well	89	44.5
(b) Hand pump	26	13.0
Tap (water supply)	46	23.0
River	39	19.5
Total	200	100.0

Different type of foods and dietary habits play an important role in formation of urinary calculi.

Dietary habits of these patients were found of special interest especially in the vegetarian patients (56%). Most of the vegetarian patients were fond of taking curries, spices, pickles and sauce in their diet. Out of 88 cases (44%) non vegetarian patients most of them were fish eaters (38 cases) and few were meat and chicken eaters (table-VI).

Table - VI

Showing dietary habit

Dietary habit	No. of cases	Percentage
Vegetarian	112	56
Non vegetarian	88	44
(a) Occasionally	28	14
(b) Meat	14	7
(c) Chicken	8	4
(d) Fish	38	19
Total	200	100

Socio-economic status was also found to be an important factor. Maximum number of cases were seen in the middle (43.5%) and lower socio-economic status (37.0%). Only 14.5% cases were of high socio-economic status (table-VII).

Table - VII

Showing socio-economic status

Socio-economic condition	No. of cases	Percentage
High socio-economic status	29	14.5
Middle socio-economic status	97	48.5
Low socio-economic status	74	37.0
Total	200	100.0

Patients presented various symptoms related to calculi. Pain in abdomen alone or with vomiting was the commonest symptom in most of the patients. According to severity of pain most of the patients presented with severe abdominal pain off and on with vomiting, 188 cases (94%), the pain alone in lumbar area radiating to back 95 cases (47.5%), pain radiating to pelvis was only in 35 cases (17.5%). Haematuria was next commonest symptom in 78 cases (39%), dysuria and increased frequency of micturition were found in 46 cases (23%). Anuria was seen in 3 cases only (1.5%) (table-VIII).

Table - VIII

Symptomatic presentation of urinary calculi

Presenting symptoms	No. of cases	Percentage
Pain off and on with vomiting	188	94
Pain in lumbar area radiating to back	95	47.5
Pain radiating to pelvis	35	17.5
Haematuria	78	39
Dysuria	46	23
Increased frequency of micturition	46	23
Anuria	3	1.5

All the patients were investigated for Hb, TLC, DLC, ESR, Blood Urea and urine examination for Albumin, Sugar and microscopic examination.

Thirty cases (15%) were anaemic (Hb below 11 gm%). Blood Urea (7 50 mg%) was elevated in 8 cases (4%). Albumin in the urine was seen in 7 cases (3.5%).

The microscopic examination of the urine for crystals and RBCs were done. The oxalate crystals were present in 134 cases (67%), phosphate crystals were seen in 16 cases (8%). RBCs were present in 1-5 in number in most of the patients. Large number of RBCs were seen in 80 cases (40%).

All the cases of this series were investigated radiologically by plain X-ray abdomen in antero-posterior view. Out of these 146 cases (73%) showed radio-opaque shadow in kidney or ureter or urinary bladder, 22 cases (11%) showed homogenous soft tissue shadow of renal outline and 32 cases (16%) showed no abnormal findings.

Table - IX

Radiological findings on plain skiagram KUB region, AP view

Radiological finding	No. of cases	Percentage
No abnormal finding	32	16
Homogenous soft tissue shadow of renal out line	22	11
Radio-opaque shadow	146	73
(a) Definite	136	68
(b) Suspicious	10	5
Total	200	100

Total 146 cases (73%) were showing radio-opaque shadow. Out of 136 males cases of our study 92 cases (66.3%) showed radio-opaque calculus and out of 64 females 54 cases (87.9%) showed radio-opaque calculus which has been shown in table-X.

Table - X

Male/female ratio of radio-opaque shadow

Sex	No. of cases	Radio-opaque shadow	Percentage
Male	136	92	66.3
Female	64	54	87.9
Total	200	146	

Ninetytwo cases of positive males renal calculus was seen in 71 cases (77.17%), out of which 11 cases were showing bilateral renal calculi, 3 cases were showing both ureteric and renal calculi. Ureteric calculus was seen in 16 (17.39%) cases and 5 (5.44%) cases were of vesical calculus. The detailed distribution of stone according to different age groups of males has been shown in table-XI.

Table - XI

Distribution of stone among male cases of different site with reference to their age groups

Age group (in years	Kidney		Ureter		Urinary bladder
	Right	Left	Right	Left	
1 - 10	-	-	-	-	2
11 - 20	1	1	1	-	-
21 - 30	11	8	3	2	-
31 - 40	12	7	5	1	-
41 - 50	15	8	2	-	3
Above 50	5	3	2	-	-

Out of 54 radio-opaque shadows in females 34 cases (62.96%) showed renal calculi, 13 cases (24.07%) showed ureteric calculi and 7 cases (12.97%) were of vesical calculus. Bilateral renal calculus was seen in 7 cases whereas both renal and ureteric calculi were seen in 4 cases.

Table - XII

Distribution of stone among female cases of different site with reference to their age groups

Age groups (in years)	Kidney		Ureter		Vesical
	Right	Left	Right	Left	
1 - 10	-	-	-	-	3
11 - 20	-	-	-	-	-
21 - 30	3	1	1	-	-
31 - 40	8	3	4	3	2
41 - 50	8	7	3	1	1
Above 50	1	3	1	-	1

The average size of renal calculus found to be in the range of 10-20 mm present in maximum number of cases (25 cases). Only 5 cases showed renal calculus more than 2 cm in diameter and 15 cases showed small renal calculi (1 to 10 mm diameter).

The ureteric calculi ranging from 3-15 mm were seen. Most of them were in the size between 1-5 mm in 14 cases. 13 cases were showing upto 10 mm size and only in 2 cases large stone of more than 20 mm in size were found.

Table - XXIV

Different size of stone in kidney and ureter region

Site	Kidney				Ureter			
Size in mm	1-5 mm	5-10 mm	10-20 mm	> 2 cm	1-5 mm	5-10 mm	10-20 mm	> 2 cm
No.of cases	3	12	85	5	14	13	-	2
Percentage	2.85	11.43	80.9	4.9	48.2	44.8	-	7.0

Vesical calculi was seen in 12 cases (8.2%). Females showed more incidence of vesical calculi 7 cases (58%) than in males 5 cases (42%).

The vesical calculi measure upto 2 cm in 4 cases (33.3%), 2-3 cm in 3 cases (25.2%) and upto 5 cm in 5 cases (42%).

Table - XXV

Different size of vesical calculi among male/female cases

SEX	MALE			FEMALE		
Size	< 2cm	2-3 cm	3-5 cm	< 2 cm	2-3 cm	3-5 cm
No.of cases	2	1	2	2	2	3
Percentage	16.6	8.4	16.6	16.6	16.6	25.2

Intravenous pyelography was done in 186 cases. Normal pyelography was seen in 26 cases. Pyelonephritis was seen in 54 cases. Out of total 54 cases showing pyelonephritis only 34 cases (62.9%) showed presence of calculi.

Most of the cases showed only partial change of hydrocalyx formation. Ureter was dilated in 22 cases (11.8%). Cystitis was seen in 8 cases (4.3%). One case showed poor function with intravasation of dye. Non-visualization of lower calyx was seen only in one case.

Total 160 cases of abnormal pyelograms hydrocalyx were seen in 42 cases (26.2%). Hydropelvis were seen only in 17 cases (10.6%). Bilateral pyelonephritis was seen only in 24 cases (15%), amputation and stretching of calyx were seen in 54 cases (33.75%). Persistant nephrogram were seen in 12 cases (7.5%).

Table - XV

Different abnormalities of intravenous pyelography

Pyelogram	No.of cases	Percentage
Stretching and amputation of calyces	54	33.75
Deformed calyces	21	13.1
Loss of calyceal cupping	15	9.3
Hydrocalyx	42	26.2
Hydropelvis	17	10.6
Dilated ureter	22	11.8
Non visualization of calyces	1	0.6
Early disappearance of cglyceal pattern	9	5.6
Persistant nephrogram	12	7.5

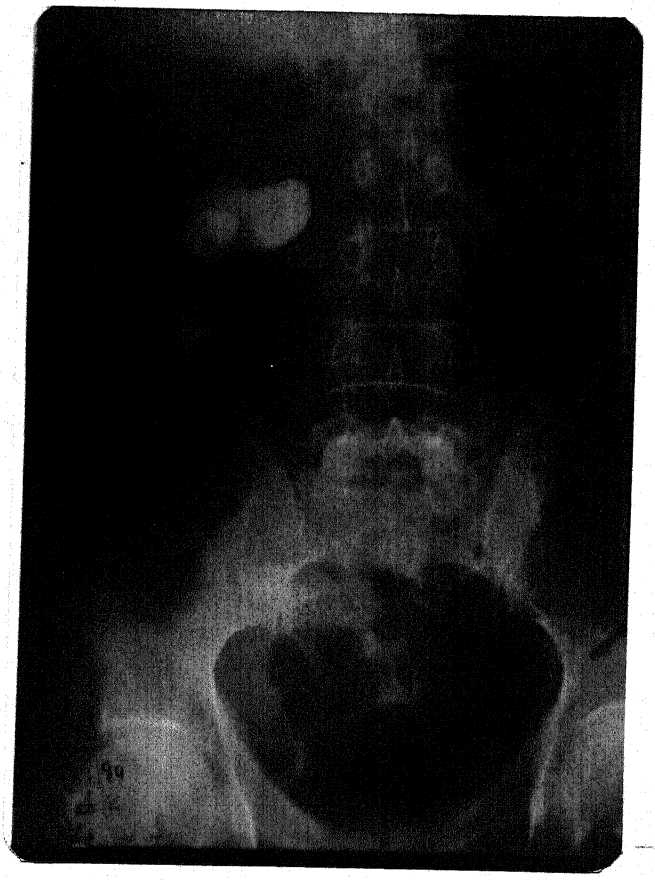


Fig.-PLAIN RADIOGRAPH SHOWING TWO LARGE RENAL CALCULI RIGHT SIDE

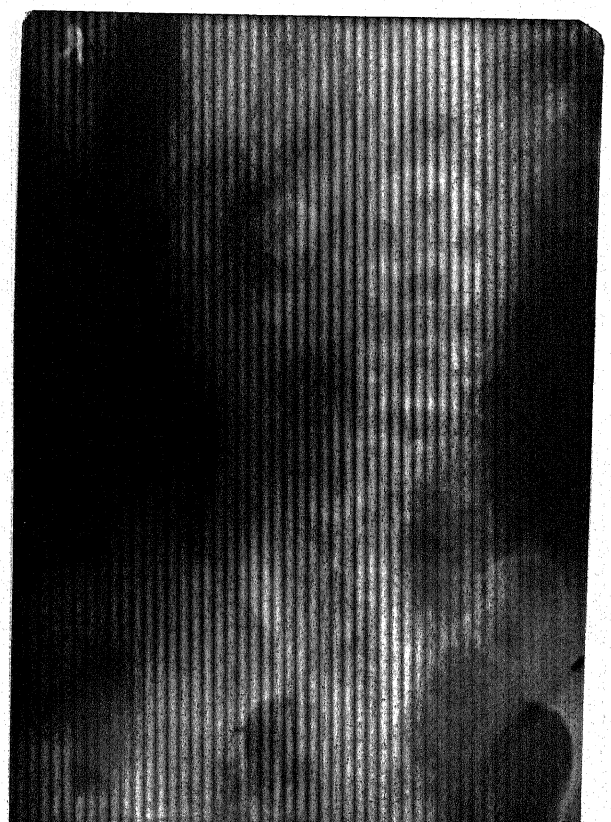


Fig.-PLAIN RADIOGRAPH SHOWING TWO RENAL CALCULI Rt. SIDE

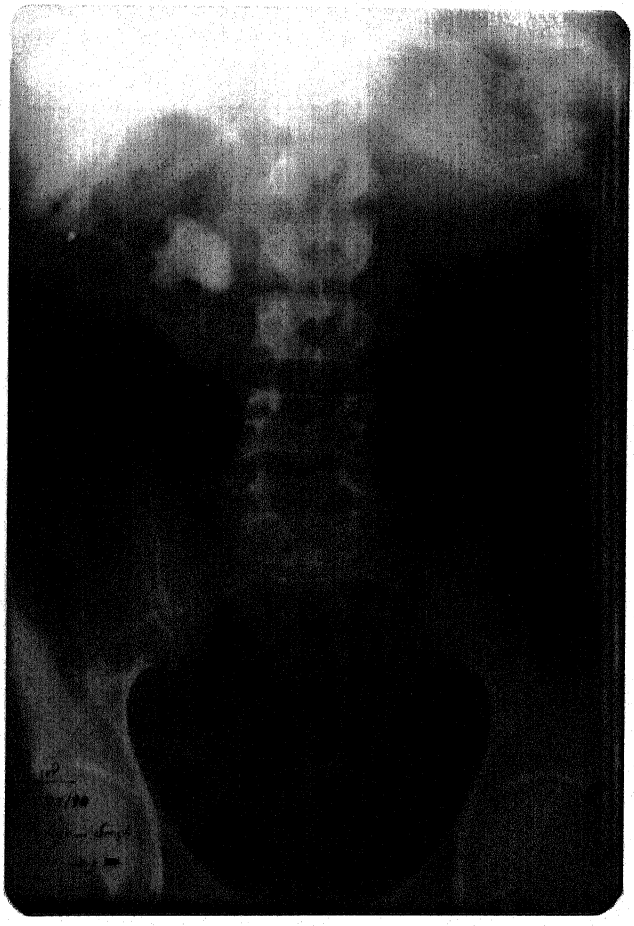


Fig.-PLAIN RADIOGRAPH SHOWING STAGHORN CALCULUS Rt. SIDE

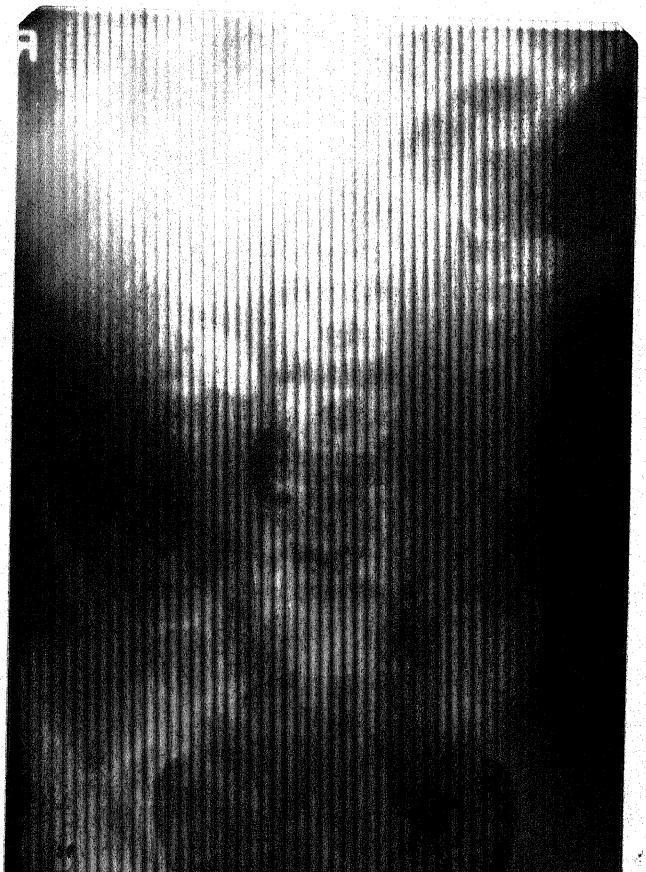


Fig.-EXCRETORY PYELOGRAM SHOWING HYDRONEPHROSIS RIGHT SIDE

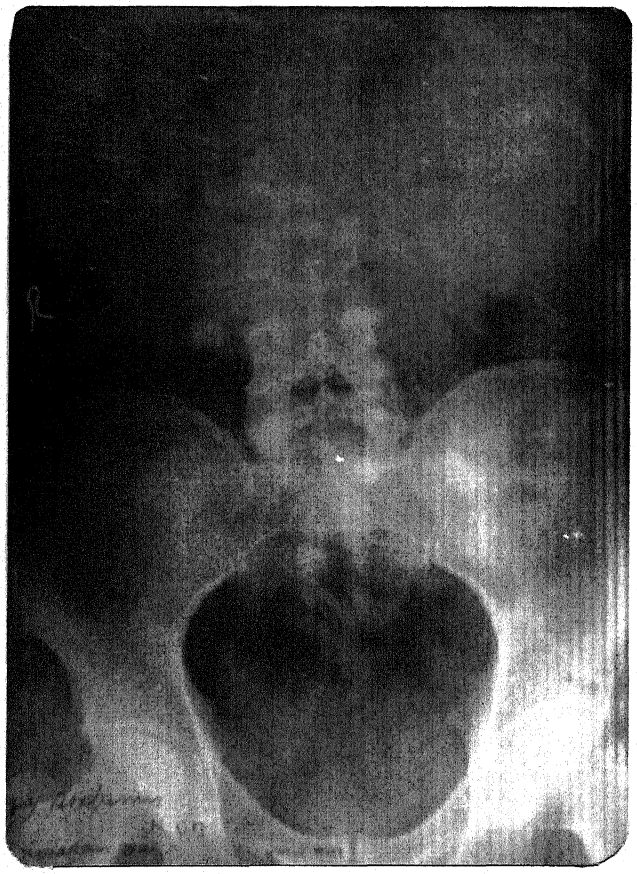


Fig.-PLAIN SKIAGRAM SHOWING URETERIC CALCULUS Rt. SIDE

Fig.-PLAIN RADIOGRAPH SHOWING URETERIC CALCULUS RIGHT SIDE (UPPER 1/3rd OF URETER)

Fig.-PLAIN SKIAGRAM SHOWING RENAL CALCULUS Lt. SIDE AND URETERIC CALCULUS Rt. SIDE

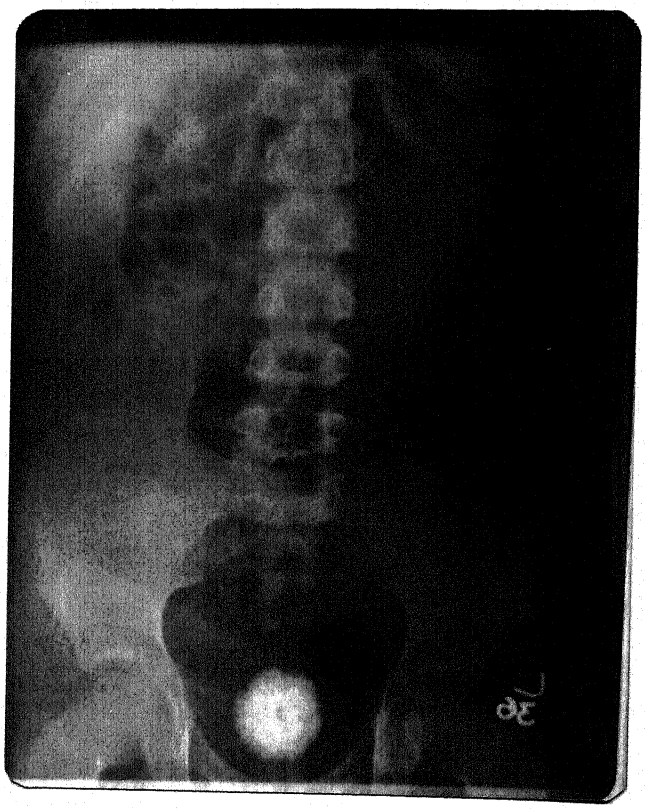


Fig. - PLAIN SKIAGRAM SHOWING VESICLE CALC-ULUS (OXALATE VARIETY)

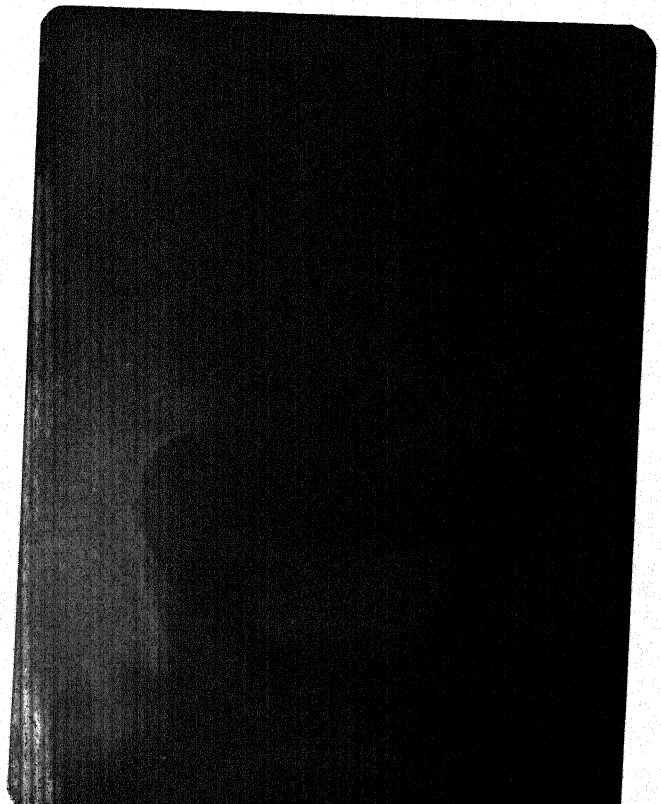


Fig.-PLAIN X-RAY SHOWING MULTILAYERED VESICLE CA-LCULUS WITH TWO NIDUS

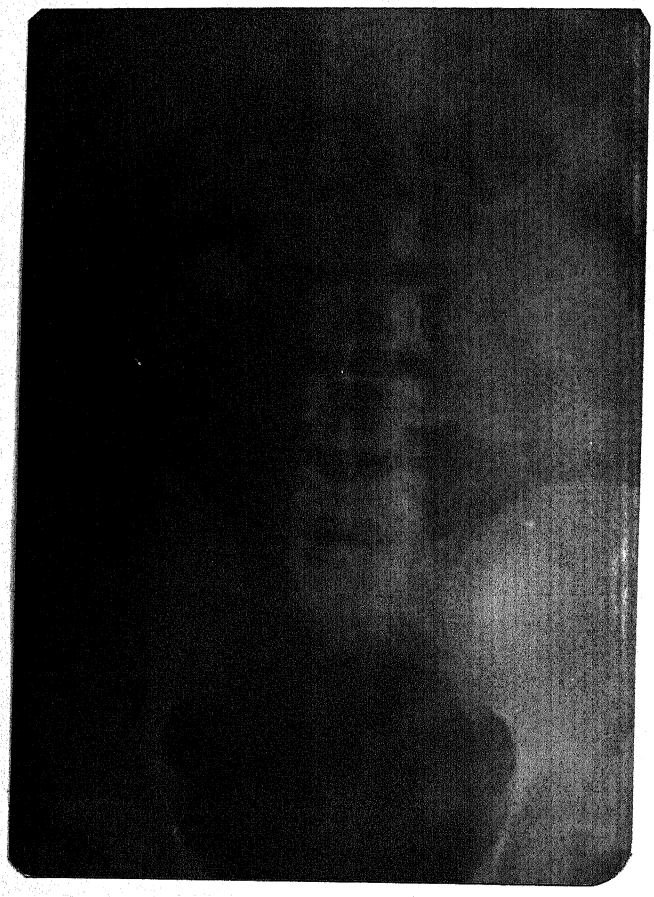


Fig.-PLAIN RADIOGRAPH SHOWING RENAL CALCULUS Rt. SIDE

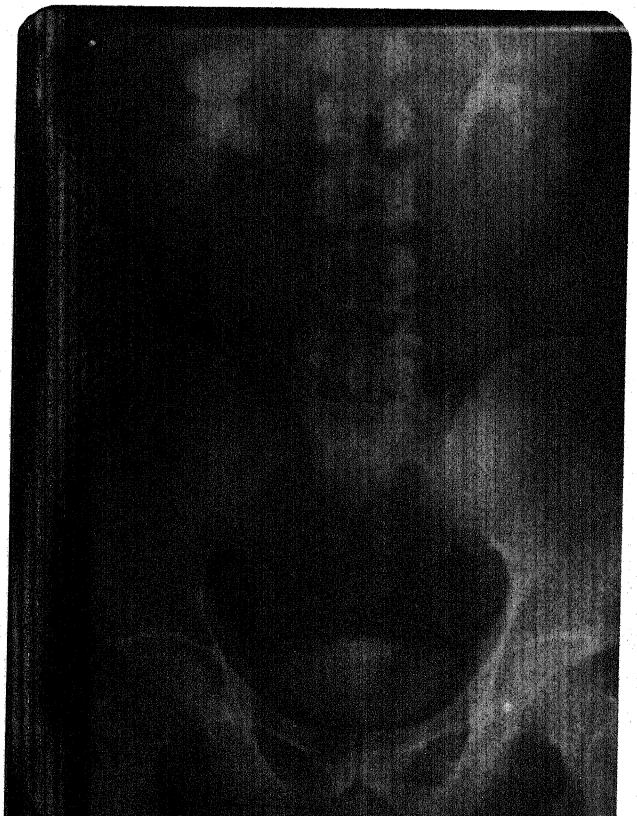


Fig.-INTRAVENOUS PYELOGRAM SHOWING HYDRONEPHROTIC CHANGES Rt. SIDE

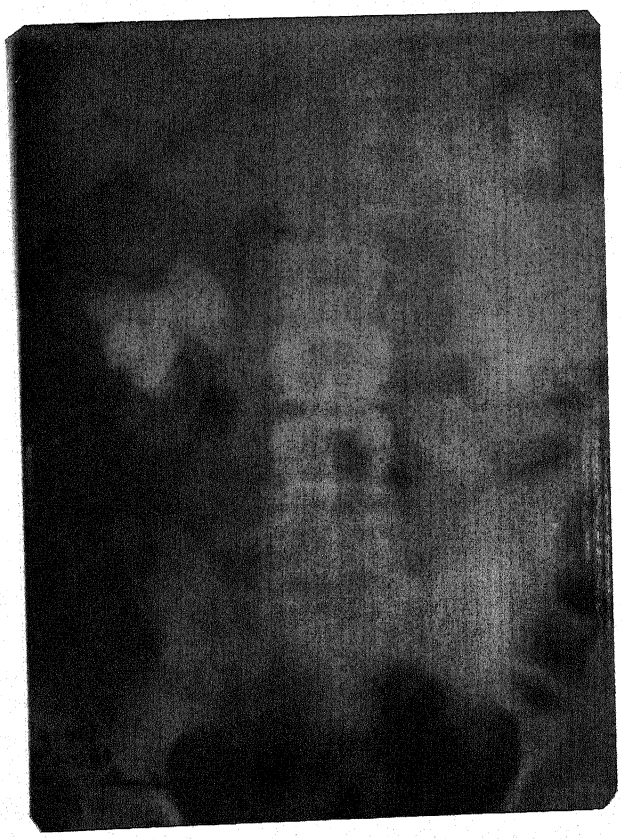


Fig.-PLAIN SKIAGRAM SHOWING STAGHORN CALCULUS Rt. SIDE

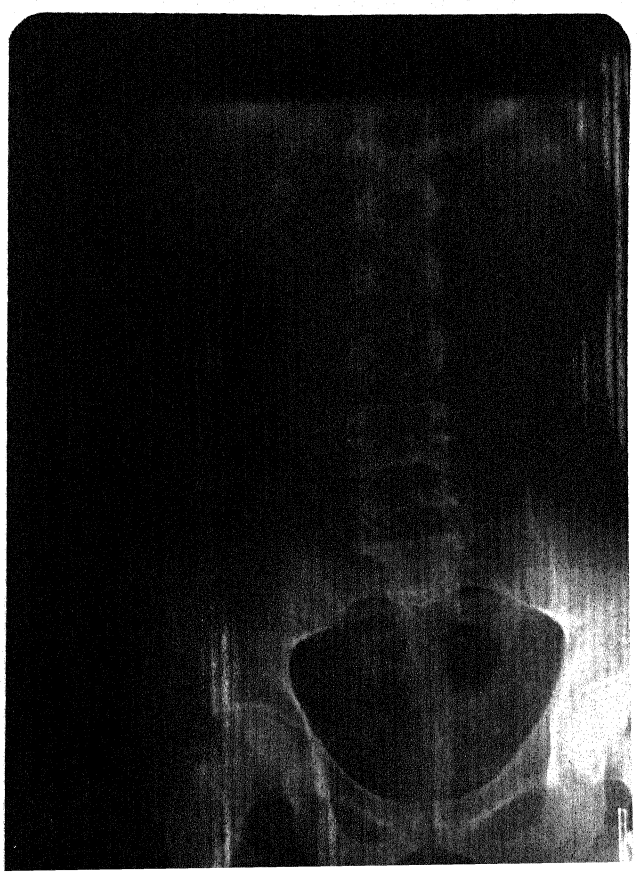
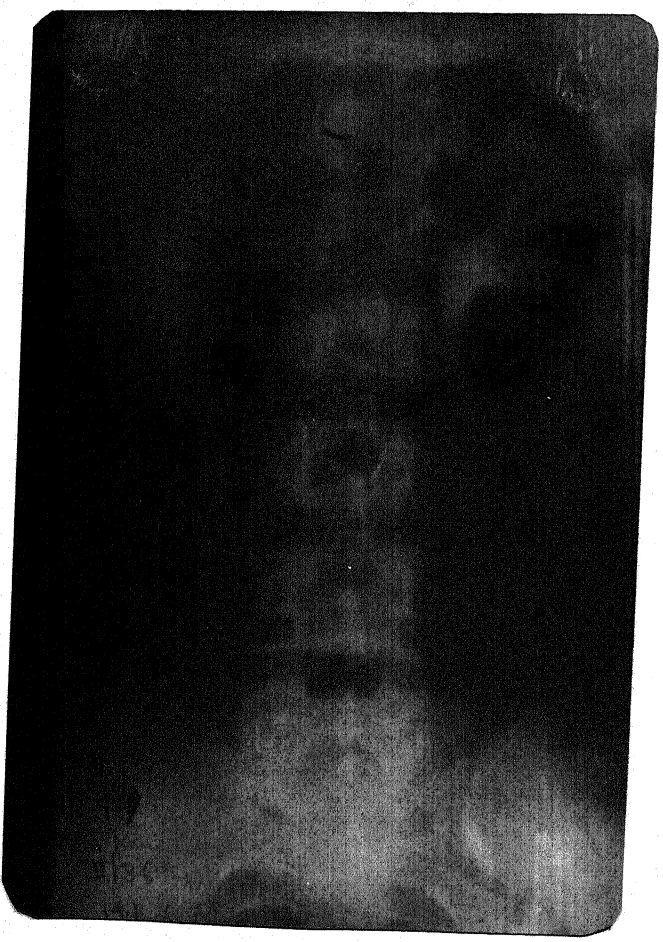
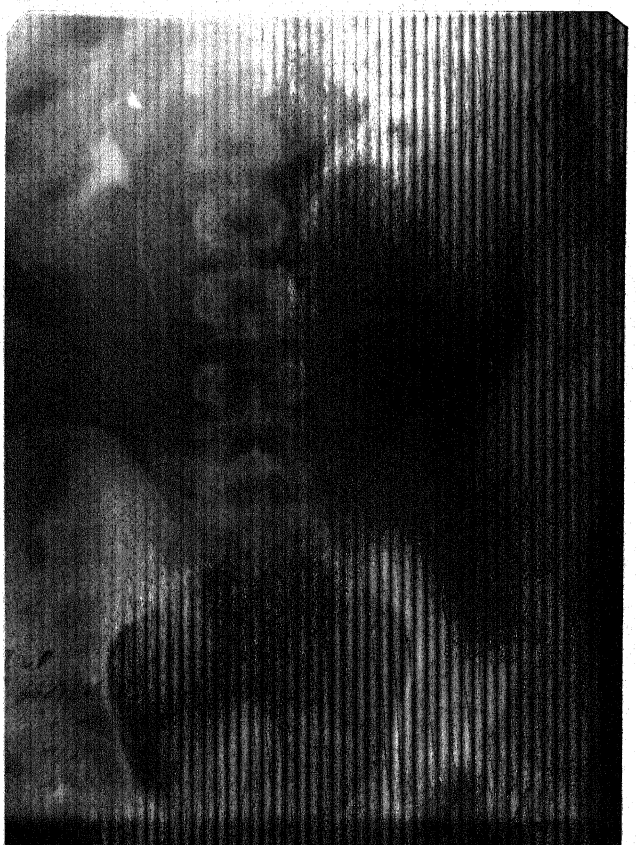


Fig.-PLAIN SKIAGRAM SHOWING RENAL CALCULUS Rt. SIDE



↑ Fig.-EXCRETORY PYELOGRAM SHOWING HYDRONEPHROSIS RIGHT SIDE

Fig.-EXCRETORY PYELOGRAM SHOWING BILATERAL HYDRONEPHROSIS WITH POOR FUNCTION OF BOTH KIDNEY



INTRAVENOUS PYELOGRAM SHOWING
NG OF DYE IN LEFT URETER AND
UCTION AT VESICO URETERIC
ION

DISCUSSION

DISCUSSION

The study "incidence of urinary calculi in abdominal pain cases", included 200 cases presenting with urinary symptoms.

In our study the urinary calculi were found to be 73% cases showing chronic abdominal pain and urinary symptoms.

Calabewall (1971) in a survey found an overall incidence of urinary calculi in patients admitted with chronic pain in abdomen in the hospital was 50.6%.

In the present series the peak age incidence of urinary calculi was seen in the age of 41-50 years.

DRACH observed peak age incidence of urinary calculi in third to fifth decades.

Blacklock, 1969; Bailey et al 1974; Burkland and Rosenberg, 1955; they all agree the peak age incidence of urinary calculi between 30-50 years.

Occurrence of urinary calculi were common among males than females. In our study male cases were 136 (68%) whereas female cases were 64 (32%). The urinary calculi among male cases were seen in 66.3%. Coe (1977) reported 67% of renal calculi in the males.

It is well established that high mineral content of water contributes to the increase prevalence of stone diseases. In the present study the population using the well water (57.5%) suffer more calculi

formation than the tap water (low mineral content) 23%.

Churchill et al (1980), Shuster et al (1982) after detailed study described that excessive water hardness contribute to the excessive calculi.

Different type of food and dietary habits plays an important role in the formation of urinary calculi. The urinary calculi were common in the vegetarian population (56%) in the present series.

Holmes (1971) in the study of Fijians found that curries, spices and pickles are more responsible for urinary calculi formation. He believed that curries contain volatile oil which are nephrotoxic. "Curry Kidney", as these causes have been called, is analogous to 'Worcestershire Sauce Kidney' described by Murphy (1967). However, unlike the Worcestershire sauce kidney (where the renal damages is associated with aminoaciduria), the curry kidney cases do not show any aminoaciduria (Johnson and Holmes, 1976).

Suvanhitanont et al (1973) found that in Thailand population, vegetarian diet is more responsible for stone formation (50%).

In the present study the urinary calculi were common among middle and low socio-economic population 48.5% and 37.0% respectively.

Robertson et al (1979) performed the extensive studies of the relationship between occupation, social

class and risk of stone formation. They confirmed that the risk of formation of calcium urinary calculi was increased in the most affluent countries, regions, societies, or individuals. These persons have more disposable income to spend on animal protein, which leads to increased urinary concentration of calcium, oxalate and uric acid. Hence it becomes difficult to assess whether occupation itself is a primary factor in stone diseases or whether it merely establishes other aspects of environment such as diet, heat exposure and water drinking alteration in these latter factors may then be the real instigators of urolithiasis.

The improvement of protein and carbohydrate ratio in the diet has decreased the incidence of urinary infection and stone formation. In Bundelkhand area being a backward region, the poor man's diet is far below than the western countries, therefore our data do not correlate with the data of Robertson et al.

In our study common symptoms were pain off and on with vomiting 94%, pain in lumbar area radiating to back 47.5%, pain radiating to pelvis 17.5%, haematuria 39%, anuria 1.5%, dysuria and increased frequency of micturition 23%.

Herman reported mordate haematuria (more than 6-8 RBCs per HPF) 57% in children and 40% in adults.

Campbell and Harrison found 43% haematuria in urinary calculi. Joly (1931) cited four types of obstruction that may be associated with calculus anuria : obstruction of both kidneys and ureters the only functioning kidney, one kidney when the opposite kidney is deceased, or one kidney when the other is normal. Hinman stated that anuria may be caused by mechanical obstruction, renal insufficiency and a combination of obstructive and renal factors. White (1929) stated that anuria may occur "as a climax of a gradual but progressive renal failure resulting from long standing and extensive bilateral calculous disease occuring quite independently of renal occlusion".

In the present study 15% patients were anaemic (haemoglobin below 11 gm%). Albumin in the urine was found in 3.5%. The oxalate crystals were present in 67%, phosphate crystals in 8% and large number of R.B.Cs were present in 40%.

Thomas Addis (1926) observed large number of RBCs in cases of urinary calculi. He observed each ml of urine contain about 1000 RBCs as a upper limit.

In the present series renal calculi were seen maximum in the 5th decades and ureteric calculi were seen maximum in 4th decades and vesical calculi were maximum in 1st decade.

Campbell and Harrison observed renal lithiasis is a disease predominantly in 3rd and 4th decade. Higgins (1939) observed 69% of ureteral calculi occured in patients aged from 20-30 years. The age incidence was similar in a series reported by Dumpus and Scholl. Joly (1931) in England and France during the nineteenth century, vesical calculous disease was largely limited to childhood. Assendelft, in a review of 630 collected cases, stated that 77% of bladder calculi occurred in patients less than 10 years of age.

In the present series renal and ureteric calculi were common among males than females as compared to vesical calculi which were common in females than males.

Campbell and Harrison observed renal and ureteric calculi occur much more often in men than in women. Jeanbrau (Joly, 1931) reported the ratio as 61% in men, 39% in women; Dumpus and Scholl, 68% men and 32% women; Revich, 69.8% men and 30.2% women. In the Cleveland Clinic series of 857 patients, 79% were men and 21% women.

In our study the size of renal calculous was found to be in the range of 10-20 mm present in maximum number of cases (80.9%). The ureteric calculi ranging from 3-15 mm were seen in most of the cases. Only 2 cases of ureteric calculi were more than 2 cm in size. The vesical calculi ranging from 2-5 cm were found in most of the cases.

Campbell and Harrison observed the size of calculi ranging from few milimeters to 10 centimeters in length and width. Heath (1922) removed a calculus 2.5 by 15 cm that weighed 65.8 gm. Despite occasional reports of such giant stones, ureteral calculi are rarely more than 2 cm in length. Randall (1937) described a calculus weighing 1816 gm. The longitudinal circumference was 48 cms and the transverse circumference was 40 cm. The bulk of calculus was composed of calcium phosphate.

In our study bilateral renal calculi were found to be present in 18 cases (17.14%) and 7 cases (5.2%) showed both renal and ureteric calculi.

Higgins in his study observed bilateral renal calculi in 224 (14.9%) of 1500 patients. H.P.N. White reported 13.8% of bilateral cases in his series; Young 17% and Braasch (1926), 10%. Braasch (1926) also stated that ureteral stones were associated with renal calculi in less than 5% of the Mayo Clinic series. Baher connelly stated that the incidence of bilateral renal calculi was 8%.

Several observers including Braasch (1917), Hughes Keyser (1934), Schall (1936) and Quinby, have discussed the apparent relationship between infection of the urinary tract and calculus formation. In our study pyelonephritis was seen in 54 cases. In his critical review of 29 patients, Hughes elicited a history of a preexisting pyelonephritis in 23.

In the present series the pyelonephritis along with urinary calculi was found in 62.9%. Cystitis was present in 4.3%.

Malek (1978) was found 38% of renal calculi along with pyelonephritis and Anhalt et al (1971) was found upto 70%. Kutzmann (1931) was reported co-existence of calculi and pyelonephritis in 26 cases out of 33 cases.

In our study Stretching and Calyx was found in 33.75%, deformed calyces in 13.1%, loss of calyceal cupping in 9.3%. Hydrocalyx in 26.2% and hydropelvis in 10.6% cases.

In Mayo Clinic series (Timmons et al 1975), 39% of patients with calyceal diverticulum had calculi. Malek and Elder (1978) was found calyceal deformity in 46% cases of pyelonephritis. Elder (1978) observed amputation and stretching of calyx in 36.3% and loss of calyceal cupping in 8.4%.

Nausea, vomiting feeling of warmth flushing and transient pain in the injected arm were frequent side effect that usually have no clinical significance or relation to more serious contrast reaction.

In our study complications observed during pyelography were minimal in most of the cases. Only two cases were developed severe anaphylactic reaction presenting feeble pulse, hypotension and breathing difficulty which could be successfully managed by good and timely efforts.

CONCLUSIONS

CONCLUSION

In the light of the present work and with a review of studies in the past, the following can be concluded :

1. The commonest age incidence of urinary calculi was in the 5th decades.
2. In males, occurrence of disease was about twice as common as in females.
3. In both the sexes the maximum occurrence of urinary calculi was in 41-50 years of age groups.
4. The commonest clinical presentation was pain off and on with vomiting, haematuria, dysuria and increased frequency of micturition.
5. The occurrence of urinary calculi was common in the rural population as compared to urban population.
6. The incidence of urinary calculi was common in the population of middle socio-economic status thereafter low socio-economic status.
7. The population using well water suffered more from calculi formation.

8. The vegetarians were afflicted more than the non vegetarians.

9. Incidence of upper urinary tract stone was more common as compared to lower urinary tract stone.

10. The commonest pyelographic finding was due to obstructive uropathy, in the form of hydrocalyx and hydropelvis.

11. Most of the renal calculi found in the range of 10-20 mm in size and ureteric calculi 3-5 mm size.

12. Pyelonephritis was present along with urinary calculi in 62.9%.

13. Complications during pyelography were minimal. Only two cases developed severe anaphylactic reaction in the form of feeble pulse and hypotension.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Addis, T. (1926). The number of formed elements in the urinary sediment of normal individuals. J. Clin. Invest., 2:409.

2. Albright, F., Sulkowitch, H.W. and Chute, R. (1939). J. Amer. Med. Ass., 113:2049.

3. Amberg, S. and McClure, W.B. (1917). AM. J. Physiol., 44:451.

4. Andersen, D.A. (1966). A Survey of the Incidence of Urolithiasis in Norway from 1853 to 1960., J. Oslo City Hosp., 16, 101.

5. Anderson, D.A. (1969). Historical and geographical differences in the pattern of incidence of urinary stone considered in relation to possible etiological factors. Renal stone research symposium, P.7(A. Hodgkinson and B.E.C. Nordin, Eds.). London: J. & A. Churchill Ltd.

6. Anderson, D.A. (1972). Environmental factors in the aetiology of urolithiasis, in urinary calculi; proceedings of International Symposium of Renal Stone Research. pp. 130-144. Basle: Karger.

7. Anhalt, H.A., Cawood, D. and Scott, R., Xantho granulomatous pyelonephritis : A comprehensive review with report of 4 additional cases. J. Urol., 105:10, 1971.

8. Bailey, R.R., Dennis, E., Greenslade, N.F. et al : Urinary stones : A prospective study of 350 patients. N.Z. Med. J., 79:961, 1974.

9. Bapna, B.C., Rao, D.V.N. and Singh, S.N. (1971). Nephrolithiasis in children : study group on urolithiasis. ICMR Technical Report Series No. S.P.29.

10. Bateson, E.M. : Renal tract calculi and climate. Med. J. Aust., 2: 111, 1973.

11. Blacklock, N.J. : The pattern of urolithiasis in the Royal Navy. In Hodgkinson, A., and Nordin, B.E.C. (Eds) : Renal Stone Research Symposium, p.33., J & A. Churchill, Ltd., 1969, London.

12. Boshamer, K. (1961). The calculus Areas of the World : Handb. Urol., 10, 34. Berlin : Springer Verlag.

13. Bumpus, H.C., Jr., and School, A.J. : Ureteral stone. Surg. Clin. N. Am., 5: 813, 1925.

14. Burkland, C.E. and Rosenberg, M. : Survey of urolithiasis in the United State. J. Urol., 73: 198, 1955.

15. Butt, A.J. : Historical Survey of Etiologic factors in Renal Lithiasis. In Etiological Factors in Renal Lithiasis, P.G., Springfield, Ill., Charles C., Thomas, 1956.

16. Cabot (1910). Trans.Amer.Urol.Ass.,4:213(Cited by Aird).

17. Carroll,G. and Brennan,R.V. (1952). The role of infection in nephrolithiasis. J.Urol.68:88-95.

18. Chulkaratana,S., Van Reen., R. and Valyasevi,A. (1971). Studies of bladder stone disease in Thailand. Factors affecting the solibility of calcium oxalate. Invest.Urol.,9,3,246.

19. Churchill,D.N., Maloney,C.M., Bear,J., Bryant, D.G., Fodor,G. and Gault,M.H. (1980). Urolithiasis - a study of drinking water hardness and genetic factors. J.Chron.Dis.,33:727.

20. Chute,R. (1939). Clinical aspects of hyperparathyroidism with special reference to urology. J.Urol., 41:762-72.

21. Cleave,T.L. and Campbell,G.D. (1966). Diabetes, Coronary Thrombosis and the Saccharine Disease. Bristol : Wright.

22. Cleave,T.L. (1974). The Saccharine Disease. Bristol : Wright.

23. Coe,F.L., Keck,J. and Norton,E.R. (1977). The natural history of calcium urolithiasis. JAMA, 238:1519.

24. Colabawalla, B.N. (1971). Incidence of urolithiasis in India. Study group on urolithiasis : ICMR Tech. Rep. Series No. 8,42.

25. Dodson, A.I. and Clark, J. (1946). Incidence of urinary calculi in American Negro. J.Amer.Med. Ass., 132:1063.

26. Eckstein, H.B. (1961). Endemic urinary lithiasis in Turkish Children : Arch.Dis.Childh., 36,137.

27. Elliot Smith : Cited by Winsbury White.

28. Flocks, R.H. (1940). The role of calcium metabolism in the pathogenesis and treatment of calcium urolithiasis. J.Urol., 43:214-33.

29. Furlow, W.L. and Buschiere, J.J. (1976). The surgical fate of ureteral calculi : review of Mayo Clinic experience. J.Urol., 116:559.

30. Garrison, F.H. (1929). History of Medicine.

31. Glenn, James, F. (1965). Surg.Gyn.Obst., 120:298.

32. Grossman, W. (1938). Current Urinary Stone Wave in Central Europe. Brit.J.Urol., 10:46.

33. Harrington, M.L. (1940). Clinical study of 480 cases of urinary lithiasis. J.Urol., 44:507.

34. Hartman, G.W., Hattery, R.R., Witten, D.M. and Williamson, B. (1982). Mortality during excretory urography : Mayo Clinic experience. Am.J. Roentgenol., 139:919.

35. Nazarika, E.Z., Balakrishna and Rao, B.N. : Upper urinary tract calculi : Analysed by X-ray diffraction and chemical methods. India J.Med.Res., 62:443, 1974a.

36. Nazarika, E.Z. and Rao, B.N., Kapur, B.M. et al : Lower urinary tract calculi analysed by X-ray diffraction and chemical methods. India J.Med. Res., 62:893, 1974b.

37. Heath, P.M. (1922). Large ureteral calculus. Brit. J.Surg., 10:153.

38. Hedenberg, I. (1951). Renal and Ureteric calculi; A study of the Occurrence in Sweden During 1911 to 1938. Acta Chir. Scand., 101, 17.

39. Hedstrand, H. and Ljunghall, S. (1975). Glucose tolerance in idiopathic calcium - stone formation. Lancet, 1:1251.

40. Herman, J.M. and Goldberg, A.G. (1960). New type of urinary calculus caused by Antacid therapy. J.Amer.Med.Ass., 174:1206.

41. Higgins, C.C. (1936). J. Urol., 36:168.

42. Higgins, C.C. (1939). Urinary lithiasis; collective review. Int.Abstr.Surg., 68:392.1939 in Surg. Gynec. & Obst.

43. Heldghinson,A. (1976). Uric acid disorders in patients with calcium stones. Brit.J.Urol.48:1.

44. Holmes,G. (1971). Urinary calculi in Fiji Indian. Med.J.Aust.2:755.

45. Ian Aird (1957). A companion of surgical studies.

46. Jeakes,A.M., Rose,G.A. and Sutor,J. (1973). Multiple Renal Silica Calculi. Brit.Med.J.,1:146.

47. Johnson,J.R. and Holmes,G. (1976). Further studies on the "Curry Kidney". Med.J.Aust.1:521.

48. Joly,J.S. (1931). Stone and Calculous Disease of the Urinary Organs. St.Louis,C.V. Mosby Co.,1931.

49. Joly,J.S. (1934). 'Aetiology of Stone'. J.Urol., 32:541.

50. Kutzmann,A.A. (1931). Replacement lipomatosis of the kidney. Surg.Gynec. & Obst. 52:690.

51. L.S. Joshi (1945). Ind.J.Surg.,69-84.June.

52. Lagergren,C. (1962). Development of Silica calculi after oral administration of magnesium silicate. J.Urol.,87:994.

53. Lemann,J., Pleasing,R.F. and Lennon,E.J. (1969). Possible role of carbohydrate induced calciuria in calcium oxalate kidney stone formation. New Engl. J.Med.,280:232.

54. Lemon,L.J., Pfeiffer,E.F. and Lemann,J. (1969). A possible mechanism for diminished renal tubular calcium and magnesium reabsorption after glucose ingestion. Clinical Research, National Meeting Abstract, 16:388.

55. Mac Geown,M.C. (1969). Hereditory in Renal Stone Disease. Clin.Sci., 19:465.

56. Malik,K.S. (1978). Xanthogranulomatous pyelonephritis : a great imitator. In Stoney,R.A. (Ed.) : J.C.E. Urol. Northfield,III, Medical digest,Inc. 1978,pp. 17-28.

57. Malik,K.S. and Elder,J.S. (1978). Xanthogranulomatous Pyelonephritis : a critical analysis of 26 cases and of the literature. J.Urol., 119:589.

58. Matas,M.J. and Krizek,M.V. (1958). Urolithiasis. Prague Statni Zdravotnicke Nakladatelstvi, 281.

59. McCarrison,R. (1931). The causation of stone in India. Brit.Med.J.1:1009.

60. Medlin,M. (1967). The etiology of renal stone. Ann.Roy. Coll.Surg.Engl.40:155.

61. Murphy,K.L. (1967). Bilateral renal calculi and amino-aciduria after excessive intake of 'Worcestershire Sauce'. Lancet, 2:401.

62. Osborne,T.B. and Mendel,L.B. (1917). J.Am.Med.Ass., 69:32.

63. Prince,C.L. and Scardino,P.L. (1960). A statistical analysis of ureteral calculi. J.Urol.,83:561.

64. Randall,A. (1921). Giant vesical calculus. J.Urol.5:119.

65. Randalls,A. (1937). The origin and growth of renal calculi. Ann.Surg.105:1009.

66. Revich,A. (1933). A critical study of ureteral calculi based on a series of 758 private cases. J.Urol.,29:271.

67. Reasor,E.F. (1935). Racial Incidence of Urolithiasis. J.Urol.,34:148.

68. Reigel,C. et al : Cited by Huggins,C.C. (1949). Etiology and management of renal lithiasis. J. Urol.,62:4.

69. Riches,E. (1968). The history of lithotomy and lithotrity. Ann.R.Coll.Surg.Engl.,43:185.

70. Robertson,W.G., Heyburn,P.J., Peacock,M., Hanes,F.A. and Swaminathan,R. : The effect of high animal protein intake on the risk of calcium stone formation in the urinary tract. Clin.Sci.,57:285,1979a.

71. Robertson,W.G., Peacock,M. and Heyburn,P.J. : Epidemiological risk factors in calcium stone formation. Fortschr. Urol.Nephrol.,14:105,1979b.

72. Robertson,W.G., Peacock,M.,Heyburn,P.J., Hanes, F.A., Rutherford,A. et al : Should recurrent calcium oxalate stone formers become vegetarians ? Br.J.Urol.,51:427,1979c.

73. Robertson,W.G., Gallagher,J.C., Marshall,D.H., Peacock,M. and Nordin,B.E.C. (1974). 'Seasonal variation in Urinary Excretion of Calcium', Brit. Med.J.,4:436.

74. Sanghem Lal (1962). Text book of Surgery. 334.

75. Scholl,A.J. (1936). Stones in the kidney and ureter. In,Cabot,H. : Modern Urology Philadelphia. Lea and Febiger,pp - 598-678.

76. Shuster,J., Finlayson,B., Scheaffer,R., Sierakowski, R., Zoltek,J. and Dzegede,S. : (1982). Water hardness and Urinary Stone disease. J.Urol.,128:422.

77. Suter,D.J., Wooley,S.E. and Illingworth,J.J. (1974). 'Some aspects of the adult Urinary Stone Problems in Great Britain and Northern Ireland', Brit.J.Urol. 46:275.

78. Suvachittanont,O., et al (1973). The oxalic acid content of some vegetables in Thiland, Its possible relationship with bladder stone disease. J.Med. Assn.Thailand,56:645.

79. Thompson,J.C. (1921). Urinary calculi at the Canton Hospital. Surg.Gynaec. & Obst.,32:44.

80. Vermeten,V. (1937). The occurrence of renal calculus and their possible relation to diet as illustrated in the south african Negros. Journal of Amer.Med.Ass.,109:857.

81. White,H.P.N. (1929). Calculous anuria. Lancet, 1:918.

82. Wilson (1931). Brit.Med.J.2:101-Cited by Jan Aird.

83. Wimsbury-White,H.P. (1954). Stone in the urinary tract. 2nd Ed. Butterworth & Co., Ltd., London.

84. Wise,R.O. and Kark,A.E. (1961). Urinary calculi and serum calcium levels in Africans and Indians. S.Afr.Med.J.,35:47.

85. Yelloly,J. (1930). Sequel to remarks on the tendency to Calculus Disease. Phil.Trans., 120:413.